

5 Apparatus on a carding machine for textile fibres, for example, cotton, synthetic fibres or the like, comprising revolving card flat bars equipped with clothing.

CROSS REFERENCE TO RELATED APPLICATION

10 This application claims priority from German Patent Application No. 10318966.1 dated 26 April 2003 the disclosure of which is incorporated herein by relevance.

15 BACKGROUND OF THE INVENTION

15 The invention relates to an apparatus on a carding machine for textile fibres, for example, cotton, synthetic fibres and the like, comprising revolving card flat bars equipped with clothing.

20 In certain known revolving card flat assemblies a space is present between the tips of the card flat clothings and the tips of the cylinder clothing and the card flat clothings form an adjustable angle with the cylinder clothing, 25 wherein the ends of the card flat bars each slide with one part on a first curved slideway and with another part on a second curved slideway and the sliding-contact surfaces of the slideways - viewed circumferentially - have different distances from 30 one another.

35 In a known apparatus (WO 00/05441), an adjusting device for the local displacement of the flexible second slideway is arranged centrally. On operation thereof, the second slideway is moved outwards or inwards in a radial direction with

respect to the cylinder. The adjusting device includes a plurality of support members, which extend from a central support member and support the second curved slide such that the radial 5 support members extend or contract in response to the position of the adjusting device. The adjusting device can operate hydraulically or pneumatically. The second guide means can be arranged in the operating region of the cylinder 10 substantially parallel to the cylinder surface; alternatively, its relative position may vary around the working surface of the cylinder, in order to change the angle of inclination of the card flats as they traverse the working region of 15 the cylinder and hence to influence the quality of carding obtained. It is not necessary to adjust each card flat bar individually; all that is required is a single adjustment of the position of the guide means with respect to the carding 20 machine in order to set the angle of inclination of all card flat bars in the flat driving chain. The high structural complexity required for displacing and adjusting the card flat bars is a disadvantage. The known apparatus is costly in 25 terms of equipment. It is a further disadvantage that the support members are only in point-contact engagement with the second slideway. In particular, it is inconvenient that the angles of 30 inclination of all the card flat bars at any one time are adjustable. In this way, either all angles of inclination can only be increased or all angles of inclination can only be decreased. This uniform alignment of the card flat bars, or rather, of the card flat bar clothings, can lead 35 to increased damage to the fibres and to nep

formation. Finally, the clothings of the card flat bars are subject to considerable wear during operation.

It is an aim of the invention to provide an 5 apparatus of the kind described in the introduction, which avoids or mitigates the said disadvantages, which in particular is of simple construction and is easy to assemble, enables the carding intensity of the card flat bars to be more 10 flexibly adjusted and allows wear of the clothing on the card flat bars to be reduced.

SUMMARY OF THE INVENTION

15 The invention provides a carding machine comprising a carding cylinder and a revolving card flat assembly comprising revolving card flat bars, the machine further having a lateral slideway assembly comprising a first curved slideway and a 20 second curved slideway and upon which ends of the card top bars can slide with a part on said first slideway and a part on said second slideway, wherein said first slideway has a first sliding-contact surface and said second slideway has a 25 second sliding-contact surface which is so located relative to the first sliding-contact surface that there is at least a first portion of said slideway assembly in which a distance in the vertical direction between the first and second sliding- 30 contact surfaces increases and a second portion of said slideway assembly in which said distance decreases.

The features according to the invention permit the angle between the clothing surface of each 35 card flat bar and the cylinder clothing - the so-

called offset angle - to be individually selected. A particular advantage comprises the fact that by specific or individual alignment of the clothing surfaces of the card flat bars in relation to one another, the ratio of fibre damage to nep formation can be quite considerably improved. Added to this is that the fact that the lasting technological improvement is rendered possible in a structurally especially simple way. The arrangement of the slideways enables additional devices for displacing the card flat bars and the slideways to be omitted. The individual adjustment of the angle of inclination is effected automatically by virtue of the fact that the sliding elements of the card flat bars slide on two sliding-contact surfaces, the mutual spacings of which both increase and decrease. In accordance with a further advantage, the individual inclination of the carding surfaces considerably reduces wear of the clothing on the card flat bars.

Advantageously, the distances of the sliding-contact surfaces of the slideways with respect to the cylinder clothing both increase and decrease. Advantageously, the distances of the sliding-contact surfaces of the slideways do not become strictly monotonously smaller or larger with respect to one another. Advantageously, the slideways are arranged side by side on each of the carding machine. The second slideway may be integrated in the first slideway. The slideways may be of one-piece construction. The slideways may be arranged separately side by side. Advantageously, two sliding elements are present on each card flat bar end, the sliding elements

being of different cross-section and/or diameter.

Advantageously, in the end region of a respective sliding element there is arranged a cylindrical element, a disc or the like, which has a larger

5 diameter than the respective other sliding element. Advantageously, at least one slideway is flexible. Advantageously, at least one slideway - in relation to the cylinder - is constructed to be displaceable in the circumferential direction.

10 Advantageously, at least one slideway is of wedge-form construction. Advantageously, the card flat bars are arranged so as to rotate about an axis of rotation parallel to the cylinder axis. Advantageously, the axis of rotation is arranged

15 in the middle of each card flat bar.

Advantageously, the angle between the carding surface of at least one card flat bar and a respective tangent to the clothing of the cylinder is adjustable. Advantageously, the angle between

20 the carding surface of at least one card flat bar and a respective radius of the cylinder is individually adjustable. Advantageously, at least one carding nip closes (offset angle) at the fibre inlet, viewed in the direction of rotation of the

25 cylinder. Advantageously, at the fibre outlet at least one carding nip opens (counter-offset angle), viewed in the direction of rotation of the cylinder. Advantageously, between fibre inlet and fibre outlet at least one angle amounts to 0° .

30 Advantageously, the card flat bar automatically assumes different offset positions as it traverses the working region from card flat inlet to card flat exit. Advantageously, the different sliding elements, e.g. slide pins, of each card flat bar

35 run on two sliding-contact surfaces (slide rails)

of different heights relative to one another. Advantageously, the different diameters of the sliding region of the sliding elements cause an offset angle, no offset angle and a counter-offset 5 angle of the card flat bar during a traverse thereof. Advantageously, the sliding elements, for example, slide pins, are fixed at the same height to the card flat bar. Advantageously, the sliding elements, for example, slide pins, are 10 not fixed at the same height to the card flat bar.

Advantageously, the height gradient between the two slide rails has an arbitrary contour (sliding-contact surface). Advantageously, at least one 15 slide rail is exchangeable for another slide rail having a different contour (sliding-contact surface). Advantageously, the two slide rails are each separately displaceable relative to one another on one side of the cylinder.

Advantageously, displacement of the slide rails is 20 effected during continuous operation.

Advantageously, as the card flat bars are being guided over the working region a different offset angle is set independently of location.

Advantageously, two slide rail tracks are present 25 and each sliding element, for example, card flat bar guide pin, moves on its own slide rail guide track. Advantageously, a slide rail with two different slide tracks is present on each side of the cylinder. Advantageously, the change in the 30 offset angle is caused by an offset in height of the slide tracks relative to one another.

Advantageously, the offset in height over the path 35 of the revolving card flat assembly is independent of location. Advantageously, the offset in height over the path of the revolving card flat assembly

is freely selectable. Advantageously, the offset in height over the path of the revolving card flat assembly has offsets in continuity, for example, of a sharp-edge nature. Advantageously, the slide 5 tracks over the path of the revolving card flat assembly, that is to say, the height offset, are unvarying. Advantageously, the slide tracks over the path of the revolving card flat assembly, that is to say, the height offset, are produced by 10 material-removing machines. Advantageously, the sliding-contact surfaces cross one another, viewed in the lateral direction. Advantageously, at the intersection point of the sliding-contact surfaces there is, viewed in the lateral direction, no 15 distance in the vertical direction between the sliding contact surfaces.

The invention also provides an apparatus on a carding machine for textile fibres, for example, cotton, synthetic fibres and the like, comprising 20 revolving card flat bars equipped with clothing, in which a space is present between the tips of the card flat clothing and the tips of the cylinder clothing and the card flat clothings form an adjustable angle with cylinder clothing, 25 wherein the ends of the card flat bars each slide with one part on a first curved slideway and with another part on a second curved slideway and the sliding-contact surfaces of the slideways - viewed circumferentially - are different distances from 30 one another, wherein the sliding-contact surfaces of the slideways are arranged so that the distances in the vertical direction between the sliding contact surface both increase and decrease.

35 The invention also provides a carding machine

comprising a carding cylinder and a revolving card flat assembly comprising revolving card flat bars, the machine further having a lateral slideway assembly comprising a first curved slideway and a 5 second curved slideway and upon which the card flat bars can slide with a first end part on said first slideway and a second end part on said second slideway, wherein said first slideway has a first sliding-contact surface and said second 10 slideway has a second sliding-contact surface which is so located relative to the first sliding-contact surface that there are at least a convergent portion and a divergent portion of said slideway assembly in which in the vertical 15 direction said first and second sliding-contact surfaces respectively converge and diverge.

BRIEF DESCRIPTION OF THE DRAWINGS

20 Fig. 1 is a schematic side view of a carding machine for an apparatus according to the invention;

25 Fig. 2 is a side view of a revolving card top showing card flat bars and a fragment of the first slideway of a two-part slideway and a flexible bend;

30 Fig. 3a is a side view of a revolving card top, showing schematically the adjustment of the angle between the card flat clothings and the cylinder clothing at the card flat outlet or fibre inlet 35 (offset angle);

5 Fig. 3b is a side view of another part of the revolving card top of Fig. 3a showing schematically the adjustment of the angle between the card flat clothings and the cylinder clothing at the card flat inlet or fibre outlet (counter-gap);

10 Fig. 4a is a perspective view of one construction of slide rail according to the invention;

15 Fig. 4b is a perspective view of a second construction of slide rails;

Fig. 4c is a perspective view of a third construction of slide rails;

20 Fig. 4d is a side view of the slide rails of Figs 4a to 4c;

Fig. 4e is section A-A in accordance with Fig. 4d;

25 Fig. 4f is section B-B in accordance with Fig. 4d;

Fig. 4g is section C-C in accordance with Fig. 4d;

30 Fig. 5a is a front view of an embodiment with slide rails of different heights, in which the sliding elements in the card flat bar are arranged at the same height and have different diameters in the end

35

region;

5 Fig. 5b is a side view of the construction corresponding to Fig. 5a, but without flexible bends and carrier element;

Fig. 5c is a perspective view of the construction according to Fig. 5b;

10 Fig. 6a is a front view of a further embodiment with sliding-contact surfaces of different heights, in which the sliding elements in the card flat bar are arranged at different heights and have 15 the same diameter in the end region;

Fig. 6b is a side view of the construction corresponding to Fig. 6a, but without flexible bends and card flat backs;

20 Fig. 6c is a perspective view of the construction according to Fig. 6b;

25 Fig. 7a is a side view of a further embodiment with slide rails of different heights, in which the sliding elements in the card-flat bar are arranged at the same height and have the same diameter in the end region, and

30 Fig. 7b is a perspective view of the construction corresponding to Fig. 7a.

DESCRIPTION OF THE PREFERRED EMBODIMENTS

With reference to Fig. 1, a carding machine, for example, a high-performance card DK 903 made by Trützschler GmbH & Co. KG of Mönchengladbach, Germany has a feed roller 1, feed table 2, licker-ins 3a, 3b, 3c, cylinder 4, doffer 5, stripping roller 6, squeezing rollers 7, 8, web-guide element 9, web funnel 10, take-off rollers 11, 12, revolving card flat assembly 13 with card flat bar guide rollers 13a, 13b and card flat bars 14, can 15 and can coiler 16. The directions of rotation of the rollers are shown by respective curved arrows. The letter M denotes the midpoint (axis) of the cylinder 4. The reference numeral 4 denotes the clothing and 4b denotes the direction of rotation of the cylinder 4. The letter C denotes the direction of rotation in the carding setting and the letter D the return transport direction of the card flat assembly.

Referring to Fig. 2, on each side of the carding machine, a flexible bend 17 having several adjusting screws is secured by means of screws laterally to the machine frame. The flexible bend 17 has a convex outer surface 17a and a lower surface 17b. Above the flexible bend 17, there is a first slideway 20, for example, of anti-friction plastics material, which has a convex outer surface 20a and a concave inner surface 20b. The second slideway 21 (see Figs 3a, 3b, 4a, 4b) is not shown. The concave inner surface 20b lies on the convex outer surface 17a. The card flat bars 14 have at both ends a respective card flat heel part 14a, secured to which in the axial direction are two steel pins 14b that slide on the convex

outer surface 20 of the slideway 20 in the direction of arrow C. The card flat clothing 14d is mounted on the lower surface of the carrier element 14c. The reference number 23 denotes the 5 tip circle of the card flat clothings 14d. On its circumference, the cylinder 4 has a cylinder clothing 4a, for example, saw-tooth clothing. The reference numeral 22 denotes the tip circle of the cylinder clothing 4a. The distance between the tip 10 circle 23 and the tip circle 22 is denoted by the letter a, and is, for example, 2/1000". The distance between the convex outer surface 20a and the tip circle 22 is denoted by the letter b. The variable radius of the convex outer surface 20a is 15 denoted by r_1 and the constant radius of the tip circle 22 is denoted by r_2 . The radius r_2 intersects the mid-point M (see Fig. 1) of the cylinder 4. The reference numeral 14c denotes the card flat back.

20 Figs 3a and 3b show (to an exaggerated degree in the drawing) the changes in the angle α and β respectively subtended between successive card flat clothings 18a, 18b, 18c and the tangent to the cylinder clothing 4a. According to Fig. 3a, 25 the pins 14b₁, 14b₃ and 14b₅ lie on the sliding-contact surface 21a of the first slideway 21 and the pins 14b₂, 14b₄ and 14b₆ lie on the sliding-contact surface 20a on the second slideway 20. The sliding-contact surface 20a, partly visible in 30 side view, is drawn with a broken line and the visible sliding-contact surface 21a is drawn with a continuous line. The distance between the tip circle 22 of the cylinder clothing 4a and the sliding-contact surface 20a is denoted by the 35 reference c₁ and the distance to the sliding-

contact surface 21a by the reference c_2 . The distance c_2 is larger than the distance c_1 . The clothing 14d of the card flat bars 14^I, 14^{II}, 14^{III} forms a respective acute angle α with the tangent to the cylinder clothing 4a, with the result that the carding nip narrows in the direction of rotation 4b of the cylinder 4. The distance between the clothing 14d and the cylinder clothing 4a is denoted at the entry of the carding nip by the letter d, and at the exit by the letter a, d being greater than a. The angle of inclination α is termed the so-called offset angle. The slow-running card flat bars 14^I, 14^{II}, 14^{III} are located in the region of the card flat guide roller 13a, that is, in the region of the card flat exit or fibre intake.

Referring to Fig. 3b, the pins 14b₈, 14b₁₀, 14b₁₂ lie on the sliding-contact surface 20a of the second slideway 20 and the pins 14b₇, 14b₉ and 14b₁₁ lie on the sliding-contact surface 21a on the first slideway 21. The sliding-contact surface 21a, visible in side view, is drawn with a continuous line and the partly visible sliding-contact surface 20a is drawn with a broken line. The distance between the tip circle 22 of the cylinder clothing 4a and the sliding-contact surface 21a is denoted by the reference c_3 and the distance to the sliding-contact surface 20a by the reference c_4 . The distance c_4 is larger than the distance c_3 . The clothing 14d of the card flat bars 14^{IV}, 14^V, 14^{VI} subtends a respective acute angle β with the tangent to the cylinder clothing 4a, with the result that the carding nip opens out in the direction of rotation 4b of the high-speed cylinder 4. The distance between the clothing 14d

and the cylinder clothing 4a is denoted at the entry of the carding nip by the letter a, and at the exit by the letter e, e being greater than a.

The angle of inclination β is termed the so-called counter-offset angle. The slow-running card flat bars 14^{IV}, 14^V, 14^V are located in the region of the card flat guide roller 13b, that is, in the region of the card flat entry or fibre outlet. Figs 3a and 3b serve to illustrate the adjustment of the offset angle and counter-offset angle. The pins 14b of identical diameters in Figs 3a and 3b can in practice instead be of the form corresponding to Figs 5a to 5c.

The angles α and β can be, for example, about 15 1°. The distance a at the narrowest point of the carding nip is for all card flat bars 14^I to 14^{VI} preferably the same or almost the same and can be, for example 3/1000".

In Figs. 4a to 4c there are shown three 20 illustrative forms of slideways suitable for use in the invention.

Fig. 4a shows two curved slideways 20 and 21, which consist, for example, of anti-friction plastics material and are flexible. The slideways 25 20, 21 are manufactured in one piece from a plastics material block, for example, by material-removing milling or similar processes. The slideways 20, 21 are formed without an intermediate space between them. Fig. 4b shows a 30 one-piece construction similar to that of Fig. 4a, but in which between the slideways 20, 21 there is an intermediate space in the form of a longitudinal groove open at one side. The one-piece constructions shown in Fig 4a and Fig 4b are 35 displaceable as a whole on the flexible bend 17 or

on a carrier element 24 in the circumferential direction of the cylinder 4. Referring to Fig. 4c, the slideways 20 and 21 are arranged on the carrier element 24 and are individually 5 longitudinally slidable in the direction of the curved arrows D, E and F, G respectively. The slideways 20 and 21 can also be arranged separately (in a manner not shown) side by side on the flexible bend 17 so as to be displaceable in 10 direction D, E and F, G. The slideways 20, 21 can be arranged with or without an intermediate space between them so as to be displaceable.

As shown in a perspective view in Fig 4a to 4b and in side view in Fig. 4d, the sliding-contact 15 surfaces 20a, 21a of the slideways 20, 21 are arranged so that they form an intersection point where they cross one another. As shown in Fig. 4e, in the region of the outlet of the card flat bar 14^I, a distance h_1 is present between the 20 height h_3 of the sliding surface 21a and the height h_4 of the sliding surface 20a. As shown in Fig. 4g, in the region of the inlet of the card flat bar 14^{VI}, a distance h_2 is present between the 25 height h_5 of the sliding surface 20a and the height h_6 of the sliding surface 21a. At the point at which the sliding-contact surfaces 20a, 21a shown in Fig. 4d intersect, Fig 4f shows that there is no distance in the vertical direction between the sliding-contact surfaces 20a, 21a. In this way, 30 the sliding-contact surfaces 20a, 21a of slideways 20, 21 are arranged relative to one another such that the distances h_1 and h_2 in the vertical direction between the sliding-contact surfaces 20a, 21a both increase and decrease. The 35 distances h_1 and h_2 of the sliding-contact surfaces

20a, 21a of the slideways 20, 21 do not become strictly uniformly either smaller or larger with respect to one another.

In the embodiment of Figs 5a to 5c, the card flat head consist of two sliding elements 14b^I, 14b^{II}, one end region of which is secured in apertures of the card flat heel part 14a (see DE-A- 43 05 148). The sliding element 14b^{II} is a cylindrical pin of stainless steel having a diameter of, for example, 6 mm; it projects beyond the end face of the card flat bar 14^{VI} by distance g. The other sliding element 14b^I consists of a cylindrical pin 14.2 having a diameter of, for example, 6 mm, at the free end of which a circular disc 14.1 of stainless steel having a diameter of, for example, 18 mm, is mounted and projects beyond the end face of the card flat bar 14^{VI} by distance f. In place of the disc 14.1, the pin 14.2 can be angled, that is, bent towards the sliding-contact surface 21a. Distance f is larger than distance g. An elongate, flexible, curved carrier element 24 is arranged on the flexible bend 17, and can be displaced parallel to the flexible bend 17 and can be of wedge-form construction. On the upper side of the carrier element 24, the two curved slideways 20 and 21 of, for example, anti-friction plastics material, are arranged in a secure manner side by side. In operation, the sliding element 14b^{II} slides on the sliding-contact surface 20a (see Figs 4a to 4c) of the slideway 20 and the disc 14.1 of the sliding element 14b^I slides on the sliding-contact surface 21a (see Figs 4a to 4c) of the slideway 21.

Because the diameter d_1 of the disc 14.1 is larger than the diameter d_2 of the pin 14b^{II} and

the distance f is larger than the distance g , at the card flat entry the sliding element $14b^I$ extends over the sliding-contact surface $20a$ to engage with the sliding-contact surface $21a$

5 arranged lower down. At the same time, the shorter sliding element $14b^{II}$ engages with the sliding-contact surface $20a$ arranged higher up. In this way, the opening carding nip of angle β is formed. As the card flat bar 14^{IV} slides in

10 direction C , at the card flat exit the sliding element $14b$, having slid beyond the intersection point of the two sliding-contact surfaces $20a$, $21a$, engages with the now lower sliding-contact surface $20a$ and the disc 14.1 engages with the

15 higher sliding-contact surface $21a$. By angling the card bars, the closing carding nip of angle α is formed at the card flat exit.

In the embodiment of Figs 6a to 6c, a further construction with sliding-contact surfaces $20a$, $21a$ of different height is provided, in which the sliding elements $14b$ in the card flat bar 14 are arranged at different heights and in their end regions have the same diameter. The two sliding elements $14b$ on each card flat bar 14 are

20 advantageously pins of stainless steel having a diameter of 6 mm. The intersection point between the sliding-contact surfaces $20a$, $21a$ has been displaced asymmetrically towards the card flat entry.

25

30 In the embodiment of Figs 7a, 7b, yet a further construction has sliding-contact surfaces $20a$, $21a$ of different height, in which the sliding elements $14b$ in the card flat bar are arranged at the same height and in, their end region are of

35 the same diameter. The sliding elements $14b$ of

this embodiment can also consist of stainless steel and have a diameter of 6 mm. In this construction, however, the intersection point between the two sliding-contact surfaces 20a, 21a 5 is arranged asymmetrically towards the card flat exit.

Although the foregoing invention has been described in detail by way of illustration and example for purposes of clarity and understanding, 10 it will be obvious that changes and modifications may be practised within the scope of the appended claims.